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FREQUENCY DISTRIBUTION OF DRY-BULB AND WET-BULB TEMPERATURES AT BIDSTON, 1946-1955

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Note: this paper is on similar lines to the M.O.3 Climatological Memoranda Nos. 1 and 10-20 and, although not prepared by a member of the Meteorological Office, is regarded as being suitable for inclusion in the series.

INTRODUCTION

The work was carried out while the author was on the staff of the Liverpool Observatory and Tidal Institute, Bidston, Birkenhead, as a result of requests from commercial and industrial interests for information relating to the frequency distribution of dry and wet-bulb temperature, and more general enquiries regarding relative humidity. In reply to these enquiries it had been possible to give little more than monthly means for Bidston and such data as are to be found in pp. 205-230 of Bilham's 'Climate of the British Isles'(1) or in pp. 100-115 of the 'Climatological Atlas of the British Isles'(2).

The investigation was undertaken to remedy this deficiency of temperature and humidity data for Merseyside and, in general, it follows the lines of Thomson's analysis for Aberdeen and Eskdalemuir(3), except that dry and wet-bulb temperatures are analysed in association.

METHOD OF TABULATION OF RESULTS

Readings at 03, 09, 15 and 21 G.M.T. for the 10-yr. period 1946-55 were tabulated, and reduced to a percentage basis for easy comparison. The data were grouped in ranges of 5°F., except that all readings below 32°F. were placed in one group. Each monthly frequency distribution in Table 1 is based on approximately 300 readings, and percentage frequencies above 1% are given to the nearest whole number. In view of the smallness of the sample, any higher degree of accuracy would be spurious. In a few instances the totals given in the summary columns and rows do not add up to exactly 100 per cent. In these instances no attempt has been made to smooth the table, and the figures in the body of the table are individually as accurate as possible.

In Table 1, for any given ranges of dry-bulb and wet-bulb temperature, two frequencies are indicated. The upper figure is the percentage frequency of occurrence within the given ranges; the lower figure is the cumulative percentage frequency of dry-bulb temperature and associated wet-bulb temperature greater than or equal to the lower values in the ranges indicated (for range 32°F. no lower temperature limit is specified).

The grouping will not introduce any loss of accuracy throughout the greater part of the frequency range, and although in this memorandum the grouping is smaller, Thomson's observation that "the tails of the frequency distributions will obviously be less accurate, but, irrespective of the size of range, the tails in any 10-yr. sample are unlikely to reflect the true population to a fine degree of accuracy" applies with equal force.

Table 2 is included to summarise the results and to demonstrate that the chosen 10-yr. sample accords very well with the long period means of temperature and humidity. The first two lines of the table give the mean temperature and relative humidity for the period analysed, while the next two lines give the long period means based on the 26-yr. period 1930-55.

From 1946 to 1953 observations were taken every two hours at the 'odd' hour i.e. 01, 03, 05,----G.M.T. From 1954 to 1955 observations were taken every three hours at the synoptic hours 00, 03, 06,----G.M.T. Daily means, from which the monthly and annual averages were computed, were directly calculated from the 8 or

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12 observations without any form of 'correction'. As the hours of observation selected for analysis in this paper, namely 03, 09, 15 and 21 G.M.T. are common to both series of readings, homogeneity is preserved.

LIST OF TABLES AND FIGURES

Table 1. Monthly percentage frequency of dry and associated wet-bulb temperatures.
" 2. Monthly mean temperature and humidity.
" 3. Percentage frequency of dry and associated wet-bulb temperatures for the year, for 03, 09, 15 and 21 G.M.T.
" 4. Percentage frequency of dry and associated wet-bulb temperatures for the year.
Fig. 1. Mean monthly ogives of wet-bulb temperature.
" 2. Mean monthly cumulative percentage frequency of wet-bulb temperatures - mean of 03, 09, 15 and 21 G.M.T. and of 09 G.M.T. separately.

USE OF THE TABLES

The tables are designed to answer three questions:-

1. For what percentage of the time on the average is the dry-bulb temperature above or below X° at 03, 09, 15 or 21 G.M.T. in a given month or in a year?

2. Same as question 1 but relating to wet-bulb temperature.

3. For what percentage of the time on the average is the dry-bulb temperature above or below X° at 03, 09, 15 or 21 G.M.T. while the associated wet-bulb temperature is above or below Z° in a given month or in a year?

Questions 1 and 2 may be answered either by direct interpolation from the tables or, if greater accuracy is desired, by plotting cumulative frequency curves from which the required frequency may be read. The cumulative percentage frequencies incorporated in Table 1 facilitate the drawing of such curves.

Question 3 is best answered by double interpolation in Table 1, although this process may be somewhat coarse owing to the use of 5°F. ranges in the tabulations, e.g. if it is required to know for what percentage of the time the dry-bulb temperature is above 60°F. while the wet-bulb temperature is above 50°F. in March, Table 1 yields the following:-

Dry-bulb	51.9°F.,	wet-bulb	41.9°F.	---- 7.8%	Total frequencies below and to right of these temperatures in Table 1, divided by 4 (or make use of cumulative frequencies).
"	56.9	"	46.9	---- 1.5%	
"	61.9	"	51.9	---- 0.25%	

These data for temperatures and associated frequencies may be plotted on graph paper and a smooth curve drawn in; from this the required frequency of 0.5% may be read off. If the depression of the wet-bulb in the example quoted above (60-50°F.) were not a multiple of 5°F. then it would be necessary to plot two graphs and interpolate between them.

DISCUSSION

Figs. 1 and 2 confirm that two of Thomson's conclusions apply also to the Bidston data:-

1. The cumulative percentage frequency curves (ogives) of wet-bulb temperature show that the months group conveniently into six pairs, namely, January and February, March and December, April and November, May and October, June and September, July and August.

2. The 09 G.M.T. wet-bulb temperature data are reasonably representative of average readings throughout the 24 hours in so far as the four series analysed here may be considered to represent adequately the diurnal variation.

Thomson's conclusions, however, that reasonable accuracy may be obtained by confining analysis to one month in each pair, and to the 09 G.M.T. data, must be considered in the light of standard errors. Any reduction of the sample size is liable to increase the uncertainty of the final results.

The substantial differences between the wet-bulb standard deviations of Table 2 and those for Aberdeen and Eskdalemuir on p. 23 of Thomson's paper indicate a differing range of variation over the British Isles and it is thus unsafe to extrapolate from a set of ogives of wet-bulb temperature for one station to determine frequencies at a station in another part of the British Isles where only the monthly mean wet-bulb temperatures are known, as suggested by Thomson on p. 26. Each area needs the consideration of local data.

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References

1. Bilham, E.G. Climate of the British Isles. MacMillan: 1938.

2. Meteorological Office. Climatological Atlas of the British Isles. H.M.S.O.: 1952.

3. Thomson, A.B. Distribution of wet-bulb temperature at Aberdeen and Eskdalemuir. M.O. Prof. Notes, No. 120: 1956.

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TABLE 2. MONTHLY MEAN TEMPERATURE AND HUMIDITY.

	UNIT	J	F	M	A	M	J	J	A	S	O	N	D
YEARS SELECTED, 1946-55													
MEAN DRY BULB.	°F	39.9	39.2	42.4	47.2	52.7	56.9	60.0	60.0	56.8	51.0	45.7	42.3
MEAN REL. HUM.	%	85	83	80	76	73	77	79	78	79	81	84	87
LONG PERIOD MEAN, 1930-55													
MEAN DRY BULB	°F	39.7	39.9	42.7	46.9	51.9	57.1	60.0	60.0	56.6	50.7	46.4	41.9
MEAN REL. HUM.	%	85	82	79	76	74	76	78	79	79	81	84	86
COMPUTED FROM FREQUENCY DISTRIBUTIONS.													
MEAN DRY BULB	°F	39.9	39.6	42.6	47.5	52.6	57.1	60.1	60.2	56.8	51.0	45.8	42.2
" WET BULB	°F	38.4	37.8	40.1	43.8	48.3	52.8	56.2	56.5	53.7	48.6	43.9	40.5
" REL. HUM.	%	86	84	79	72	71	73	78	78	81	83	85	85
" DEW POINT	°F	36	35	36	39	43	48	52	53	51	46	42	38
" VAPOUR PRESSURE	mb	7.3	7.1	7.3	8.1	9.6	11.7	13.6	13.8	12.8	10.6	9.0	7.7
STANDARD DEVIATION. DRY	°F	6.2	6.3	6.5	5.1	6.5	5.5	5.5	5.0	4.8	5.8	5.4	5.9
" " WET	°F	5.8	5.6	5.8	4.5	5.1	4.7	4.2	3.7	4.2	5.9	5.1	5.6

ANNUAL VALUES	UNITS	03 hr.	09 hr.	15 hr.	21 hr.	AVER-AGE
MEAN DRY BULB.	°F	47.3	49.3	52.5	49.3	49.6
" WET BULB.	°F	45.2	46.5	48.3	46.6	46.6
" REL. HUM.	%	84	79	71	80	79
" DEW POINT	°F	43	43	43	43	43
" VAPOUR PRESSURE	mb	9.3	9.4	9.6	9.5	9.4
STANDARD DEVIATION - DRY	°F	8.3	9.5	9.9	8.6	9.6
" " - WET.	°F	8.0	8.5	8.4	8.1	8.3

TABLE 3 PERCENTAGE FREQUENCY OF DRY AND WET-BULB TEMPERATURES FOR THE YEAR.

0300 HOURS

DRY-BULB TEMPERATURE

WET-BULB TEMPERATURE	< 32	32.0-36.9	37.0-41.9	42.0-46.9	47.0-51.9	52.0-56.9	57.0-61.9	62.0-66.9	67.0-71.9	72.0-76.9	TOTAL
< 32	4.0	2.2									6.2
32.0-36.9		6.1	4.6								10.7
37.0-41.9			10.3	8.0	<0.1						18.3
42.0-46.9				11.8	9.3	0.2					21.3
47.0-51.9					11.7	9.0	<0.1				20.7
52.0-56.9						9.9	6.1				16.0
57.0-61.9							4.4	1.9	<0.1		6.3
62.0-66.9								0.4	<0.1		0.4
67.0-71.9										<0.1	<0.1
TOTAL	4.0	8.3	14.9	19.8	21.0	19.1	10.5	2.3	0.1	<0.1	

0900 HOURS

DRY-BULB TEMPERATURE

WET-BULB TEMPERATURE	< 32	32.0-36.9	37.0-41.9	42.0-46.9	47.0-51.9	52.0-56.9	57.0-61.9	62.0-66.9	67.0-71.9	72.0-76.9	77.0-81.9	TOTAL
< 32	3.8	1.6										5.4
32.0-36.9		5.9	3.9									9.8
37.0-41.9			7.9	7.5	0.2							15.6
42.0-46.9				10.2	8.8	0.6						19.6
47.0-51.9					8.6	9.7	1.0	<0.1				19.3
52.0-56.9						7.4	10.4	1.0	<0.1			18.8
57.0-61.9							4.0	4.7	1.1			9.8
62.0-66.9								0.3	1.1	0.2		1.6
67.0-71.9										<0.1	<0.1	<0.1
TOTAL	3.8	7.5	11.8	17.7	19.1	17.7	15.4	6.0	2.2	0.2	<0.1	

TABLE 3 (CONT)

1500 HOURS.

DRY-BULB TEMPERATURE

WET-BULB TEMPERATURE	<32	32.0-36.9	37.0-41.9	42.0-46.9	47.0-51.9	52.0-56.9	57.0-61.9	62.0-66.9	67.0-71.9	72.0-76.9	77.0-81.9	82.0-86.9	87.0-91.9	TOTAL
<32	1.2	1.4												2.6
32.0-36.9		3.5	4.4	0.2										8.1
37.0-41.9			5.7	6.9	0.7									13.3
42.0-46.9				7.6	10.6	1.2	<0.1							19.4
47.0-51.9					5.8	10.7	3.1	0.3						19.9
52.0-56.9						3.8	12.2	3.9	0.3	<0.1				20.2
57.0-61.9							2.7	7.1	1.8	0.6				12.2
62.0-66.9								0.6	2.2	1.0	0.1	<0.1		3.9
67.0-71.9									0.1	0.2	0.2	<0.1		0.4
72.0-76.9													<0.1	<0.1
TOTAL	1.2	4.8	10.1	14.7	17.1	15.7	18.0	11.9	4.3	1.8	0.3	<0.1	<0.1	

2100 HOURS

DRY-BULB TEMPERATURE

WET-BULB TEMPERATURE	<32	32.0-36.9	37.0-41.9	42.0-46.9	47.0-51.9	52.0-56.9	57.0-61.9	62.0-66.9	67.0-71.9	72.0-76.9	77.0-81.9	TOTAL
<32	2.8	1.6										4.4
32.0-36.9		4.8	3.9	<0.1	<0.1							8.7
37.0-41.9			8.0	8.5	0.1							16.6
42.0-46.9				10.2	9.8	0.4						20.4
47.0-51.9					9.6	11.1	0.7	0.1				21.5
52.0-56.9						7.6	9.8	0.6				18.0
57.0-61.9							4.7	3.6	0.5			8.8
62.0-66.9								0.8	0.5	0.2	<0.1	1.5
67.0-71.9									<0.1	<0.1	<0.1	0.1
TOTAL	2.8	6.4	11.9	18.7	19.5	19.1	15.2	5.1	1.0	0.2	<0.1	

TABLE 4. PERCENTAGE FREQUENCY OF DRY AND WET-BULB TEMPERATURES FOR THE YEAR.

DRY-BULB TEMPERATURE

WET-BULB TEMPERATURE	<32	32.0-36.9	37.0-41.9	42.0-46.9	47.0-51.9	52.0-56.9	57.0-61.9	62.0-66.9	67.0-71.9	72.0-76.9	77.0-81.9	82.0-86.9	87.0-91.9	TOTAL
< 32	3.0	1.7												4.7
32.0-36.9		5.1	4.2	.05	.01									9.3
37.0-41.9			8.0	7.7	.3									16.0
42.0-46.9				10.0	9.5	.6	.01							20.1
47.0-51.9					9.0	10.1	1.2	.1						20.4
52.0-56.9						7.2	9.7	1.4	.08	.01				18.4
57.0-61.9							3.9	4.3	.8	.1				9.1
62.0-66.9								.5	1.0	.3	.04	.01		1.8
67.0-71.9									.03	.07	.08	.01		.2
72.0-76.9													.01	.01
TOTAL	3.0	6.8	12.2	17.7	18.8	17.9	14.8	6.3	1.9	.5	.1	.02	.01	

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Table 1. Monthly Percentage Frequency of Dry and associated Wet-bulb temperatures.

January (3,9,15 and 21 G.M.T.)

Dry-bulb °F / Wet-bulb °F	< 32				32.0-36.9				37.0-41.9				42.0-46.9				47.0-51.9				52.0-56.9				MEAN
	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	
32	14	15	6	11	5	5	5	5																	17
	100	100	100	100	86	85	94	89																	
32.0-36.9					18	19	14	15	8	8	13	9								0.3					26
					81	80	89	84	63	61	75	69								17					
37.0-41.9									20	20	18	20	9	8	11	10									29
									55	53	62	60	35	33	44	40									
42.0-46.9													12	13	15	13	6	4	8	8					20
													26	25	33	30	14	12	18	17					
47.0-51.9																	6	5	7	8	2	3	3	0.6	9
																	8	8	10	9	2	3	3	0.9	
52.0-56.9																								0.3	0.1
																								0.3	
MEAN	11				21				29				23				13				2				

February (3, 9, 15 and 21 G.M.T.)

Dry-bulb °F / Wet-bulb °F	< 32				32.0-36.9				37.0-41.9				42.0-46.9				47.0-51.9				52.0-56.9				57.0-61.9				MEAN
	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	
< 32	20	16	6	15	6	5	7	7																					21
	100	100	100	100	80	84	95	85																					
32.0-36.9					17	19	11	13	12	11	14	8		0.4															26
					74	79	88	78	57	60	77	65		49															
37.0-41.9									20	17	14	20	8	11	15	9		0.4											29
									45	49	63	57	25	32	49	37		17											
42.0-46.9													9	10	17	17	6	4	5	4		0.7							18
													17	21	33	28	8	11	17	11		7							
47.0-51.9																	1	6	4	5	0.7	1	6	2		0.4			7
																	2	7	11	7	0.7	1	7	2		0.4			
52.0-56.9																							0.4						0.1
																							0.4						
MEAN	14				21				29				24				9				3				0.1				

March (3,9,15 and 21 G.M.T.)

Dry-bulb °F / Wet-bulb °F	< 32				< 32.0-36.9				37.0-41.9				42.0-41.9				47.0-51.9				52.0-56.9				57.0-61.9				62.0-66.9				MEAN
	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	33	9	15	21	
< 32	9	6	0.6	4	8	6	1	4																									10
	100	100	100	100	91	94	99	96																									
32.0 -36.9					15	14	6	10	8	10	13	13			1																		23
					83	88	98	92	68	74	92	82			71																		
37.0 -41.9									20	14	8	14	9	10	16	13			1														26
									60	64	78	69	40	50	70	55			43														
42.0 -46.9													16	20	11	16	9	10	18	14			3	1		0.3							
													31	40	53	42	15	20	42	26			20	6		5							30
47.0 -51.9																	5	6	4	6	1	4	11	4	0.3	3			0.3				
																	6	10	21	11	1	4	17	5	0.3	5			1				11
52.0 -56.9																							1			0.6	0.7		1				
																							3			2	0.7		1				0.8
MEAN	5				10				25				28				18				6				1				0.3				

April (3, 9, 15 and 21 G.M.T.)

Dry-bulb °F / Wet-bulb °F	32.0-36.9				37.0-41.9				42.0-46.9				47.0-51.9				52.0-56.9				57.0-61.9				62.0-66.9				67.0-71.9				MEAN
	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	
< 32	0.3																																0.1
	100																																
32.0 -36.9	3	0.3		0.3	8	4	1	4			0.3	0.3																					5
	100	100		100	97	99	99	100			96	91																					
37.0 -41.9					21	6	2	6	23	24	10	24	0.3	0.7	4	0.7																	30
					89	95	98	96	68	89	96	90	24	51	80	49																	
42.0 -46.9									21	14	6	17	12	25	28	24	0.7	2	5	1													39
									45	65	82	66	24	51	76	49	4	17	40	11													
47.0 -51.9													8	9	8	14	2	11	19	6		0.7	5	0.7		1							21
													11	24	43	24	3	15	35	10		3	14	2		5							
52.0 -56.9																	0.3	1	2	2	0.7	2	4	0.7		3	0.3						4
																	1	3	10	3	0.7	2	8	1		4	0.3						
57.0 -61.9																															1		
																															1		0.3
MEAN	1				13				35				33				13				3				1				0.3				

May (3,9,15 and 21 G.M.T.)

Dry-bulb °F / Wet-bulb °F	37.0-41.9				42.0-46.9				47.0-51.9				52.0-56.9				57.0-61.9				62.0-66.9				67.0-71.9				72.0-76.9				77.0-81.9				MEAN
	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	
32.0	3							0.3																													0.8
-36.9	100							100																													
37.0	6	1	0.6	0.6	14	6	2	8		1	2	0.6																									10
-41.9	97	99	100	100	91	99	99	99		87	95	86																									
42.0					15	6	2	5	23	20	14	19	1	3	4	1																					28
-46.9					77	91	95	91	62	85	93	86	20	51	73	47																					
47.0									19	15	7	20	10	19	19	24		5	9	4		0.6	1	0.6													38
-51.9									38	63	75	66	19	47	69	46		23	45	16		7	21	5													
52.0													5	6	5	6	2	9	14	6		3	9	2		0.3	2				0.3						17
-56.9													9	23	39	17	4	17	35	11		6	20	4		2	8				4						
57.0																	1	2	0.6	1	0.3	1	3	0.3		0.6	2	0.6			2						4
-61.9																	2	5	9	3	0.6	3	9	2		2	6	2			4					
61.0																					0.3			0.3		1		1			1			0.3			1
-66.9																					0.3			1		1		1			2			0.6		
67.0																																			0.3		0.1
-71.9																																			0.3		
MEAN	3				15				35				26				13				5				2				0.8				0.1				

June (3,9,15 and 21 G.M.T.)

Dry-bulb °F / Wet-bulb °F	42.0-46.9				47.0-51.9				52.0-56.9				57.0-61.9				62.0-66.9				67.0-71.9				72.0-76.9				77.0-81.9				82.0-86.9				MEAN
	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	
37.0	1																																				0.3
-41.9	100																																				
42.0	3			0.7	13	4	1	3	0.3	2	0.3	0.7																									7
-46.9	99			100	96	100	100	99	57	89	97	88																									
47.0					86	7	3	8	20	23	13	30		3	6	2		0.3	1	0.7																	36
-51.9					82	94	99	96	56	87	96	88		50	75	42		18	38	13																	
52.0									20	14	8	16	8	22	28	20		3	10	2	0.3																38
56.9									36	60	76	55	16	46	68	39		17	37	12	5																
57.0													6	7	3	7	2	9	14	6	3	4	1			2										16
-61.9													8	21	30	17	2	14	27	10	5	13	3			5										
62.0																	0.3		0.3	1	1	4	1		1	2	0.3									3
-66.9																	0.3		7	3	2	7	2		1	3	0.6									
67.0																							0.3			0.3	0.3			0.3				0.3			0.4
-71.9																							0.6			0.9	0.3			0.6				0.3			
MEAN	1				16				37				28				12				4				1				0.1				0.1				

July (3, 9, 15 and 21 G.M.T.)

Dry-bulb °F / Wet-bulb °F	42.0-46.9				47.0-51.9				52.0-56.9				57.0-61.9				62.0-66.9				67.0-71.9				72.0-76.9				77.0-81.9				82.0-86.9				87.0-91.9				MEAN
	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	
42.0-46.9	0.3				0.3					0.3																													0.2
	100				99					99																													
47.0-51.9					6	1		1	19	10		15	0.3	0.6	4	0.7				0.3																			15
					99	100		100	93	99	100	100	47	75	95	73				23																			
52.0-56.9									27	14	4	12	19	28	25	32		4	9	2		0.3																	44
									74	89	95	84	47	75	91	72		37	60	23		11																
57.0-61.9													19	10	6	17	6	20	24	14	0.3	4	6	3			1												33
													28	42	57	38	9	32	51	21	0.9	10	24	5			7											
62.0-66.9																	2	2	3	2	0.3	5	11	1		0.6	3				0.3	0.3			0.3				8
																	3	8	20	4	0.6	6	17	2		1	6				2	0.6			0.6			
67.0-71.9																							0.3		0.3		1		0.6		1	0.3							0.9
																							3		0.3		2		0.6		1	0.3						
72.0-76.9																																					0.3			0.1
																																					0.3		
MEAN	0.1				2				26				40				22				8				1				0.6				0.1				0.1			

August (3, 9, 15 and 21 G.M.T.)

Dry-Bulb °F / Wet-bulb °F	42.0-46.9				47.0-51.9				52.0-56.9				57.0-61.9				62.0-66.9				67.0-71.9				72.0-76.9				77.0-81.9				82.0-86.9				MEAN
	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	
42.0-46.9	0.3																																				0.1
	100																																				
47.0-51.9					4	0.3		0.3	15	7	2	9		2	2	1																					11
					99	100		100	95	100	100	100		75	95	72																					
52.0-56.9									30	18	3	19	20	30	29	30		2	8	1			0.6														48
									80	91	97	90	50	73	93	71		31	57	24			23														
57.0-61.9													17	12	7	17	11	18	24	12		5	4	2			2										33
													30	41	56	40	13	29	49	23		11	22	7			10										
62.0-66.9																	2		3	4	0.3	5	8	3		0.3	5	1		1							8
																	2		19	9	0.3	6	16	5		0.6	8	1		2							
67.0-71.9																							0.3	0.3		0.3	0.3	0.3		1				0.3				0.7
																							2	0.6		0.3	2	0.3		1				0.3			
MEAN	0.1				1				26				42				21				7				2				0.5				0.1				

September (3,9,15 and 21 G.M.T.)

Dry-bulb °F / Wet-bulb °F	42.0-46.9				47.0-51.9				52.0-56.9				57.0-61.9				62.0-66.9				67.0-71.9				72.0-76.9				MEAN
	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	
37.0 -41.9	1	0.7		0.7																									0.6
	99	100		100																									
42.0 -46.9	3	2		1	7	3	3	5		0.3	1	0.3																	6
	98	99		100	95	97	100	99		87	96	87																	
47.0 -51.9					16	7	1	7	24	20	14	25	0.3	0.7	5														30
					88	94	96	94	72	87	95	87	26	49	74														
52.0 -56.9									22	18	7	21	16	27	31	22			6			0.3							43
									48	66	76	62	26	48	69	41			29			9							
57.0 -61.9													6	11	9	9	3	8	13	8	0.3	4			0.3				18
													10	21	32	19	4	10	23	10		1	9			2			
62.0 -66.9																	0.7	1	1	1	0.3	0.7	3	0.3		1	0.3		2
																	1	2	5	2	0.3	0.7	4	0.6		1	0.3		
67.0 -71.9																										0.3			0.1
																										0.3			
MEAN	2				12				30				34				10				2				0.5				

October (3, 9, 15 and 21 G.M.T.)

Dry-bulb °F / Wet-bulb °F	32.0-36.9				37.0-41.9				42.0-46.9				47.0-51.9				52.0-56.9				57.0-61.9				62.0-66.9				67.0-71.9				MEAN
	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	
32.0 -36.9	1	1			5	0.6		2																									2
	100	100			99	99		100																									
37.0 -41.9					7	7	1	2	4	7	5	8			0.6	0.3																	10
					94	99	100	99	87	92	99	97			90	76																	
42.0 -46.9									16	12	4	13	15	14	17	17			0.6														27
									83	85	93	89	67	73	89	76			63														
47.0 -51.9													22	21	10	20	10	14	25	14		0.3	2										35
													52	59	72	59	30	38	62	39		1	29										
52.0 -56.9																	10	11	8	11	7	6	12	7		0.3							18
																	20	23	35	25	10	12	27	14		9							
57.0 -61.9																					3	6	6	5	0.3	0.3	8	2					8
																					3	6	15	7	0.3	0.3	9	2					
62.0 -66.9																															0.6		0.1
																															0.6		
MEAN	0.5				6				17				34				26				14				3				0.1				

November (3,9,15 and 21 G.M.T.)

Dry-bulb °F / Wet-bulb °F	< 32				32.0-36.9				37.0-41.9				42.0-46.9				47.0-51.9				52.0-56.9				57.0-61.9				62.0-66.9				MEAN
	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	
< 32	1	2		1	1	0.7	0.3	0.3																									2
	100	100		100	99	98	100	99																									
32.0					6	5	2	4	4	5	4	3																					8
-36.9					98	97	100	99	92	92	98	95																					
37.0									16	13	7	13	12	10	12	16	0.3																25
-41.9									88	87	94	92	72	74	87	79	36																
42.0													24	24	18	22	13	15	22	16		0.3											39
-46.9													60	64	75	63	36	40	57	41		20											
47.0																	15	16	15	17	2	3	10	2									20
-51.9																	23	25	34	25	8	9	19	8									
52.0																					4	5	6	4	1	1	2	1					6
-56.9																					6	6	9	6	2	1	3	2					
57.0																									0.7	0.3	1	0.7			0.3		0.7
-61.9																									0.7	0.3	1	0.7			0.3		
MEAN	1				5				16				35				32				9				2				0.1				

December (3,9,15 and 21 G.M.T.)

Dry-bulb °F / Wet-bulb °F	32				32.0-36.9				37.0-41.9				42.0-46.9				47.0-51.9				52.0-56.9				57.0-61.9				MEAN
	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	3	9	15	21	
< 32	3	8	1	2	6	2	4	4																					7
	100	100	99	100	97	93	98	98																					
32.0					14	14	9	14	9	8	8	8																	21
-36.9					91	91	94	94	77	77	85	80																	
37.0									15	17	17	19	14	12	13	13													30
-41.9									68	69	77	72	53	52	60	53													
42.0													20	20	20	18	6	7	11	8									27
-46.9													39	40	47	40	19	20	27	22									
47.0																	10	10	10	10	2	2	5	3					13
-51.9																	13	13	16	14	3	3	6	4					
52.0																					0.6	0.7	1	1			0.3		0.9
-56.9																					0.6	0.7	1	1			0.3		
MEAN	4				17				25				33				18				4				0.1				

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